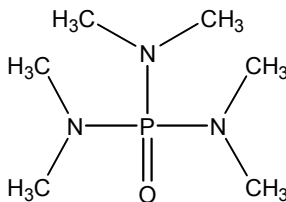


HEXAMETHYLPHOSPHORAMIDE

CAS No. 680-31-9

First Listed in the *Fourth Annual Report on Carcinogens*



CARCINOGENICITY

Hexamethylphosphoramide *is reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (CHIP, 1982c; IARC V.15, 1977). When administered by inhalation, the compound induced nasal tumors in rats of both sexes. Nasal epidermoid carcinomas were the predominant type of tumor observed; however, other nasal tumors included adenoid squamous carcinomas, papillomas, transitional carcinomas, and adenocarcinomas.

There is no adequate data available to evaluate the carcinogenicity of hexamethylphosphoramide in humans (IARC V.15, 1977).

PROPERTIES

Hexamethylphosphoramide is a clear, colorless liquid with an aromatic odor. It is miscible with water and most organic liquids, except for high-boiling saturated hydrocarbons. Hexamethylphosphoramide does not hydrolyze in alkaline media, but hydrolyzes slowly in acids. When heated to decomposition, it emits toxic fumes of phosphorus oxides (PO_x) and nitrogen oxides (NO_x). The technical grade has a minimum purity of 99%.

USE

Hexamethylphosphoramide is used as a solvent for polymers, a selective solvent for gases, a polymerization catalyst, a stabilizer against thermal degradation in polystyrene, an additive to polyvinyl and polyolefin resins to protect against degradation by ultraviolet light, a solvent in organic and organometallic reactions in research laboratories, a de-icing additive for jet fuels, a rodenticide, and a processing solvent for aromatic polyamide fiber. Formerly, the major U.S. producer of the chemical used it only as a processing solvent for aromatic polyamide fiber (CHIP, 1982c; IARC V.15, 1977). Hexamethylphosphoramide also has been tested as a chemosterilant for insects. However, carcinogenicity data led to discontinuance of testing and there is no indication that this chemical will ever be registered by EPA under FIFRA. It has also been tested as a flame retardant, but there is no indication that it is used commercially for this purpose (CHIP, 1982c).

PRODUCTION

The Chem Sources USA directory identified one producer of an unspecified volume and 19 suppliers of hexamethylphosphoramide in 1986 (Chem Sources, 1986). EPA reported that two companies were producing the chemical in 1982, but no production volume was reported (CHIP, 1982c). The 1979 TSCA Inventory identified three U.S. producers and one importer of hexamethylphosphoramide in 1977. No production volume is specified, but the compound is included in a CBI Aggregate category that indicates annual U.S. production was less than 1 million lb (TSCA, 1979). No data on imports or exports were available.

EXPOSURE

The primary routes of potential human exposure to hexamethylphosphoramide are inhalation, ingestion, and dermal contact. In air it exists solely in the vapor phase. If released to soil or water, it may leach rapidly in soil and sediments. It degrades rapidly with photochemically produced hydroxyl radicals. NIOSH estimated in a 1975 survey that the use of this compound as a solvent in United States research laboratories may have resulted in the possible exposure of 90% of the estimated 5,000 people potentially exposed to hexamethylphosphoramide in laboratories (NIOSH, 1975). The risk of potential occupational exposure exists for workers involved in the production of hexamethylphosphoramide, in its use as a solvent and chemical additive, and during the packaging of consumer products. The National Occupational Exposure Survey (1981-1983) indicated that 700 total workers, including 51 women, potentially were exposed to hexamethylphosphoramide in the workplace (NIOSH, 1984). EPA reported that data pertaining to disposal sites of wastes indicate a potential for release of detectable quantities of the compound into the soils, drainage water, and well waters in proximity to these sites (CHIP, 1982c). Release of hexamethylphosphoramide into the air and water from production and processing activities has been documented (CHIP, 1982c). However, data on current releases are not available. ACGIH has noted the potential contribution to the overall exposure by the cutaneous route, including mucous membranes and eyes, either by airborne, or more particularly, by direct contact with the substance; hexamethylphosphoramide is considered a suspected human carcinogen and no TLV is recommended (ACGIH, 1986).

REGULATIONS

EPA regulates hexamethylphosphoramide under the Superfund Amendments and Reauthorization Act (SARA) and the Toxic Substances Control Act (TSCA). Hexamethylphosphoramide is subject to reporting requirements under SARA. Under TSCA, any significant new uses of the chemical must be reported to EPA. EPA has proposed regulating hexamethylphosphoramide under the Resource Conservation and Recovery Act (RCRA) as a hazardous constituent of waste. NIOSH recommends that the chemical be treated as a potential human carcinogen and that exposure be limited. OSHA regulates hexamethylphosphoramide under the Hazard Communication Standard and as a hazard in laboratories. Regulations are summarized in Volume II, Table B-71.